**Objectives:**

* Describe how energy drives movement and change in the hydrosphere and atmosphere. You should also be able to predict circulation in the atmosphere and hydrosphere may change due to global warming.

**Causal Principles**

1. Gravitational energy, thermal energy and/or chemical **energy** drive all movement and change of matter on Earth.

3. Matter moves and changes to return a system to **equilibrium.**

1. **Temperature** is a measure of the movement of molecules. Higher temperature means molecules are moving faster.
2. When molecules move faster, the **density** of most substances decreases. Water is an anomaly because liquid water is more dense than ice.
3. **Buoyancy** causes materials to rise or fall due to the relative density of materials.

**PART 1: Class Demonstration**

**Describe below how temperature and salinity effect density of air and water:**

**Part 2: Group Work – Thermohaline Circulation**

We will begin looking atmosphere and ocean circulation by aligning features with causal principles. For each feature listed below about the atmosphere, please list causal principles that are related. \*Use the causal principles listed at the beginning of this activity.

Table A.

|  |  |
| --- | --- |
| **Atmosphere** | **Principle** |
| Hot and cold regions |  |
| Heat from the ground |  |
| Hot and cold air |  |
| Hadley convection cells |  |

Complete Table B like we did during the class example. One of the features in Table B does not correspond to a principle that causes thermohaline circulation. Write no principle in that box in the table.

Table B.

|  |  |
| --- | --- |
| **Oceans** | **Principle** |
| Hot and cold regions |  |
| Heat from the ocean surface |  |
| Hot and cold water |  |
| Cold saltier water in polar regions |  |

**Part 3: Homework – Comparing the two systems**

\*Submit your responses on ANGEL\*

While analogies are very useful, they all have their limits. Part of the reason for the limits is that not all features match. Complete the table below with features in the atmosphere and oceans that determine the density of fluids and the kind of energy (e.g. solar, gravitational, chemical, etc.) that is the primary source of energy for movement.

Table C.

|  |  |  |
| --- | --- | --- |
|  | Atmosphere | Oceans |
| Features related to density |  |  |
| Primary source of energy for movement |  |  |

**True or False**:

During ocean circulation, warm water rises in the equatorial regions.

*TRUE FALSE (circle one)*

The ocean circulation transfers heat to the polar regions.

*TRUE FALSE (circle one)*

**Short Answer**

What two factors can cause the circulation of fluids (ex. air, water)?

How might global warming impact the circulation of fluids?